Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

(A Constituent Institute of Manipal University)
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SEVENTH SEMESTER B.TECH. DEGREE END SEMESTER EXAMINATIONS NOV/DEC 2015
SUBJECT: PATTERN RECOGNITION (BME 421)
(REVISED CREDIT SYSTEM)
December 01, 2015 2PM to 5PM

TIME: 3 HOURS **MAX. MARKS: 100**

Instructions to Candidates:

1. **Answer any FIVE full questions.**
2. **Draw labeled diagram wherever necessary**

1. (a) In an EEG (electroencephalogram) classification problem, eight EEG-features form the elements of a feature vector ($X = [x_1 \quad x_2 \quad x_3 \quad . \quad . \quad . \quad x_7 \quad x_8]^T$). Write an expression to find the likeliness of occurrence of a class (C_j), using posterior probability $P(C_j / X)$. Describe how this relationship help in classifying an EEG segment with an appropriate decision rule. 10

(b) A certain study, on a population suffering from a lung disorder (**class-LD**) has shown that 8/10 were smokers **(s)** and 4/6 lived in cities (**c**). However these fractions are 4/10 and 2/6, respectively, for those without any lung problems (**class-NL**). Find the posterior probability $P(LD/s,c)$, if the probability of lung disorder was 0.011 in the overall population (assume that smoking habits and living location are independent). 04

(c) Explain how scatter-plot helps in the visualization of patterns. 06

2. (a) A feature "x" is normally distributed for *class-A* and *class-B*, and their prior probabilities are P (A) and P (B) respectively. Note that P (A) =0.6 and P (B) = 0.4. Find the equation for optimal decision boundary between the two classes, using Bayes theorem. 08

(b) Consider the classes given in question-2(a). Further the details associated with the classes are given in the following :
class-A : $\mu_A = 0$ and $\sigma_A = 1$
class-B: $\mu_B = 1$ and $\sigma_B = 2$
Find the optimal decision regions. 06

(c) Realize the NAND function using McCulloch Pitt's neuron model. Draw the network and describe its testing procedure. 06

3. (a) Describe, the agglomerative clustering algorithm, and define the" average linkage distance" between two clusters C_i and C_j. 06

(b) The details of two features (corresponding to four samples) are given in the table-1. Discover the two clusters using the “average linkage distance” , using similarity measure based on city block distance. Draw the tree diagram and discuss the cluster-details at different hierarchy levels. 08

Table-1

	Feature (x)	Feature (y)
Sample1	2	1
Sample2	3	2
Sample3	5	4
Sample4	7	7

(c) Draw a general block diagram pertaining to a chromosome classification system. Explain the concept behind classification. 06

4. (a) What are “behavioral biometric patterns”? With a neat block diagram, explain a signature identification system suggesting the possible four important features. 08

(b) Draw the flowchart pertaining to the perceptron-training algorithm. Show that it can be used to realize a NOR function. 06

(c) Define the terms “true positive rate” and “false negative rate”, and describe their significance in association with classifier-testing. 06

5. (a) The clusters obtained while partitioning the samples are *cluster-C1* and *cluster-C2*. Their details are given in the following: 08

- *cluster-C1* ={(2,,2), (2.5,4),(3.5,5),(4,5)}
- *cluster-C2* = {(7.5,7.7),(8.9,8)}

Divide the *cluster-C1* into two sub-clusters, using Forgy’s clustering algorithm.

(b) What is the need for digital blood slide analysis? Explain the possible features to be considered for identifying the white blood cells available in a digitized blood slide. 06

(c) Find the inter-cluster distance between the *cluster-C1* and *cluster-C2*, using complete linkage rule (by calculating the sample distance using Euclidian distance). 06

6. (a) Sketch the master flowchart associated with the Backpropagation training algorithm. 06

(b) Explain the rules used for updating the weights of the back propagation neural network, using error function. 06

(c) The backpropagation network (shown in figure 1) is initialized with the following weights: $[v_{11} \quad v_{21} \quad v_{o1}] = [06 \quad -0.1 \quad 0.3], [v_{12} \quad v_{22} \quad v_{o2}] = [-0.3 \quad 0.4 \quad 0.5]$,

$[v_{11} \quad v_{21} \quad v_{o1}] = [06 \quad -0.1 \quad 0.3]$ and $[w_1 \quad w_2 \quad w_0] = [0.4 \quad 0.1 \quad -0.2]$. 08

For an input vector, $X = \begin{bmatrix} 0 & 1 \end{bmatrix}^T$, find the response of the hidden and output nodes. Use the binary sigmoidal activation function, and assume that the learning rate as 0.25.

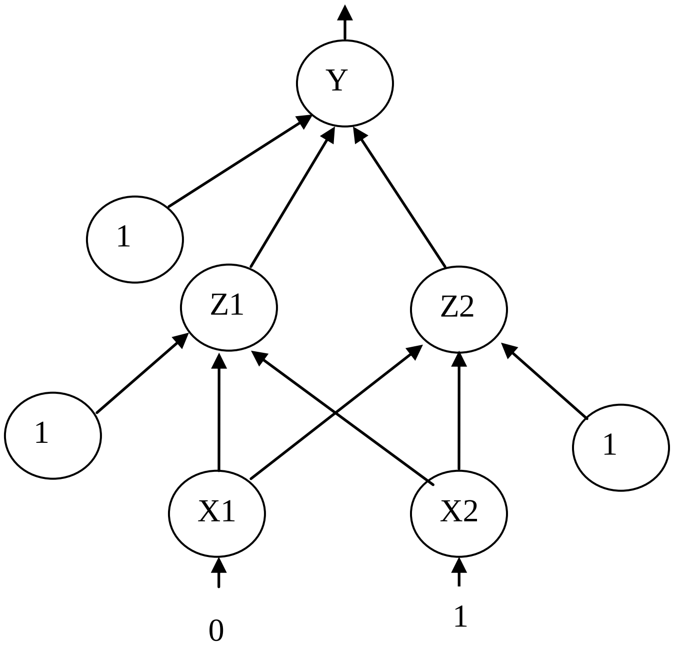

Figure 1